ABRASIVE MATERIALS.

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INTRODUCTION.

The abrasive materials that are included in this report are as follows: Oilstones and scythestones, grindstones and pulpstones, buhrstones and millstones, pumice, infusorial earth and tripoli, crystalline quartz and feldspar, garnet, corundum and emery, carborundum, crushed steel, and artificial corundum. Of these materials, there is in some cases but a small part of the entire production that is actually used for abrasive purposes, and in the following report there is included, with the exception of infusorial earth and tripoli, only that portion of the production that is actually used for abrasive purposes. Thus, under grindstones and pulpstones, which are obtained from sandstone, only a small percentage of the stone that is quarried is used in the manufacture of these abrasives, the remainder being used for building purposes. This is also true of certain of the materials from which oilstones and scythestones are manufactured. In the case of buhrstones and millstones, the larger part of the material that is taken out from the quarries is used in the manufacture of these stones. All of the pumice is used for abrasive purposes in one form or another. Of the crystalline quartz that is mined in the United States, only a very small part is used for abrasive purposes, and this is also true of feldspar. All of the garnet that is mined, except that which is of value as gems, is used as an abrasive material, and this is also true of corundum and emery.

Descriptions of the different abrasives have appeared in preceding reports of this Bureau. Thus, oilstones and whetstones were described fully in the report for 1901, and grindstones, buhrstones, millstones, and infusorial earth and tripoli in the reports for 1900 and 1901. Deposits of infusorial earth, in Pinal County, Ariz., were described by Mr. W. P. Blake[a] in 1902. Pumice was treated in the report for 1901, and artificial abrasives in the same report. In the report for 1903 an article on carborundum by Mr. F. A. J. Fitzgerald was quoted from the Iron Age,[b] and also an abstract on crushed steel, from the Proceedings of the American Association for the Advancement of Science.[c]

More or less brief descriptions of the natural abrasives will be found in The Non-Metallic Minerals, by Mr. George P. Merrill.[d] Corundum has been treated in the first volume of the North Carolina Geological Survey and also in Bulletin No. 269 of the United States Geological Survey.[e]

The features of the year in the production of abrasive materials were the further decrease in the production of grindstones and pulpstones and the lowest recorded figure for corundum and emery. The latter is offset by the increased quantity of artificial abrasives, the alundum or artificial corundum output being the largest so far recorded, and carborundum being stronger than in 1905, though

[a] Am. Inst. Min. Eng., February meeting, 1902.
[b] Iron Age, October 15, 1903.
[c] Proc. Am. Assn. Adv. Sci., Pittsburg meeting, 1903.
[d] Merrill, George P., The Non-Metallic Minerals, 1904.
[e] Ann. Rept. North Carolina Geol. Surv., vol. 1, 1905; Bull. U. S. Geol. Survey No. 269, 1905.

still below the large production of 1904. All of the other natural abrasive materials listed in these tables showed an increased value in 1906 over 1905.

The total value of the natural abrasive materials produced during 1906 was $1,473,393, as compared with $1,427,980 in 1905, an increase of $45,413. There are given in the following table the values of the different abrasive materials produced in the United States from 1902 to 1906:

Value of abrasives produced in the United States, 1902–1906.

Kind of abrasive.	1902.	1903.	1904.	1905.	1906.
Oilstones and scythestones	$221,762	$366,857	$188,985	$244,546	$268,070
Grindstones and pulpstones	667,431	721,446	881,527	777,606	744,894
Buhrstones and millstones	59,808	52,552	37,338	37,974	48,590
Pumice	2,750	2,665	5,421	5,540	16,750
Infusorial earth and tripoli	53,244	76,273	44,164	64,637	72,108
Crystalline quartz	84,335	76,908	[a] 74,850	[a] 88,118	[a] 121,671
Garnet	132,820	132,500	117,581	148,095	157,000
Corundum and emery	104,605	64,102	57,235	61,464	44,310
Total	1,326,755	1,493,303	1,407,101	1,427,980	1,473,393

[a] Including feldspar used for abrasive purposes.

There were 25 different States which contributed to the production of natural abrasive materials in 1906, and they are given below in the order of the importance of the value of their respective productions, together with the kind of abrasive mined:

List of States producing abrasives in 1906.

1. OHIO: Grindstones, pulpstones, oilstones and scythestones.
2. NEW YORK: Millstones, infusorial earth, and emery.
3. ARKANSAS: Oilstones.
4. MICHIGAN: Grindstones and scythestones.
5. CONNECTICUT: Infusorial earth and crystalline quartz.
6. MISSOURI: Grindstones and infusorial earth.
7. MINNESOTA: Feldspar.
8. NEW HAMPSHIRE: Scythestones.
9. MASSACHUSETTS: Emery.
10. VERMONT: Scythestones.
11. INDIANA: Scythestones.
12. WEST VIRGINIA: Grindstones.
13. NEBRASKA: Pumice.
14. VIRGINIA: Millstones.
15. PENNSYLVANIA: Millstones, crystalline quartz, and garnet.
16. CALIFORNIA: Infusorial earth.
17. WISCONSIN: Crystalline quartz.
18. ILLINOIS: Infusorial earth.
19. NORTH CAROLINA: Millstones.
20. KENTUCKY: Infusorial earth.
21. MARYLAND: Infusorial earth.
22. GEORGIA: Infusorial earth.
23. MONTANA: Grindstones.
24. KANSAS: Emery.
25. WYOMING: Grindstones.

In 1905 there were 23 States that contributed to the production of abrasive materials. Of these South Dakota and Idaho had no production in 1906, while Illinois, Kansas, Kentucky, and Maryland are new on the list.

The total value of the artificial abrasives manufactured during 1906 amounted to $777,081, as compared with $701,400 in 1905, an increase of $75,681. In quantity the total production in 1906 amounted to 11,774,300 pounds, as compared with 9,820,000 pounds in 1905 and 11,870,380 in 1904. This is an increase of 1,954,300 pounds over 1905 and a decrease of 86,080 pounds from the large production of 1904. The quantity of artificial abrasives—carborundum, crushed steel, and alundum (artificial corundum)—produced in the United States during the last five years is shown in the following table:

Artificial abrasives produced in the United States, 1902–1906, in pounds.

Kind of abrasive.	1902.	1903.	1904.	1905.	1906.
Carborundum	3,741,500	4,759,890	7,060,380	5,596,000	6,225,300
Crushed steel	735,000	755,000	790,000	612,000	837,000
Alundum (artificial corundum)	.....	.....	4,020,000	3,612,000	4,712,000

The total estimated value of all abrasive materials consumed in the United States for the years 1902 to 1906, inclusive, are given in the table following:

Total value of all abrasive materials consumed in the United States, 1902–1906.

Year.	Natural abrasives.	Artificial abrasives.	Imports.	Total value.
1902	$1,326,755	$390,245	$426,736	$2,143,736
1903	1,493,303	493,815	621,575	2,608,693
1904	1,407,101	830,926	547,804	2,785,831
1905	1,427,980	701,400	654,821	2,784,001
1906	1,473,393	777,081	909,964	3,160,438

BUHRSTONES AND MILLSTONES.

PRODUCTION.

The production of buhrstones and millstones in the United States during 1906 was valued at $48,590. This is an increase of $10,616, though the value still falls below that for 1901, 1902, and 1903, all of which were over $50,000. The production came from 22 producers in the following 4 States: New York, 14 producers; Virginia, 3; North Carolina, 2; and Pennsylvania, 3. Though stone suitable for buhrstones and millstones is found in other States, there was no production from them reported to this office.

In the following table are given the values, by States, of buhrstones and millstones produced in the United States from 1902 to 1906:

Value of buhrstones produced in the United States, 1902–1906, by States.

State.	1902.	1903.	1904.	1905.	1906.
New York	$39,570	$35,441	$24,585	$25,915	$28,848
Virginia	11,435	9,812	4,759	8,186	15,611
North Carolina and Vermont	6,825	5,902	[a] 6,500	[a] 2,522	[a] 1,507
Pennsylvania	1,978	1,397	1,494	1,351	2,624
Total	59,808	52,552	37,338	37,974	48,590

[a] No production of buhrstones from Vermont in 1904, 1905, and 1906.

The following table gives the value of buhrstones produced in the United States since 1880:

Value of buhrstones produced in the United States, 1880–1906.

1880	$200,000	1894	$13,887
1881	150,000	1895	22,542
1882	200,000	1896	22,567
1883	150,000	1897	25,932
1884	150,000	1898	25,934
1885	100,000	1899	28,115
1886	140,000	1900	32,858
1887	100,000	1901	57,179
1888	81,000	1902	59,808
1889	35,155	1903	52,552
1890	23,720	1904	37,338
1891	16,587	1905	37,974
1892	23,417	1906	48,590
1893	16,639		

IMPORTS.

The value of the imports of buhrstones and millstones into the United States has not varied greatly during the last three years, and is given in the following table for the last five years:

Value of buhrstones and millstones imported into the United States, 1902–1906.

Year.	Rough.	Made into millstones.	Total.	Year.	Rough.	Made into millstones.	Total.
1902	$15,243	$915	$16,158	1905	$30,478	$938	$31,416
1903	21,160	8,481	29,641	1906	32,921	277	33,198
1904	30,117	2,269	32,386				

Annual production of corundum and emery, 1881–1906, in short tons.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1881	500	$80,000	1894	1,495	$95,936
1882	500	80,000	1895	2,102	106,256
1883	550	100,000	1896	2,120	113,246
1884	600	108,000	1897	2,165	106,574
1885	600	108,000	1898	4,064	275,064
1886	645	116,190	1899	4,900	150,600
1887	600	108,000	1900	4,305	102,715
1888	589	91,620	1901	4,305	146,040
1889	2,245	105,567	1902	4,251	104,605
1890	1,970	89,395	1903	2,542	64,102
1891	2,247	90,230	1904	1,916	56,985
1892	1,771	181,300	1905	2,126	61,464
1893	1,713	142,325	1906	1,160	44,310

IMPORTS.

The demand for corundum and emery in 1906 in the United States was principally supplied by imports. The latter amounted to $521,082 in value, as compared with $347,425 in 1905, and exceeded the home production by nearly 12 times. The following table shows the quantity and value of emery and corundum imported into the United States in the last five years:

Emery and corundum imported into the United States, 1902–1906.

Year.	Grains.		Ore and rock.		Other manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Value.	
	Pounds.		*Long tons.*			
1902	1,665,737	$49,107	7,157	$151,959	$13,776	$214,842
1903	3,595,239	109,272	10,884	[a] 194,468	17,829	321,569
1904	2,281,193	109,772	7,054	[b] 138,931	11,721	260,424
1905	3,209,915	143,729	11,073	185,689	18,007	347,425
1906	4,655,668	215,357	13,841	286,386	19,339	521,082

[a] Including emery rock valued at $5,488. [b] Including emery rock valued at $7,338.

CANADIAN CORUNDUM.

The production of Canadian corundum in 1906 amounted to 2,274 short tons, valued at $204,973, as compared with 1,644 short tons, valued at $149,153, in 1905, an increase of 630 short tons in quantity and of $55,820 in value.

In the following table are given the quantity and value of the production of Canadian corundum during the last five years:

Production of Canadian corundum, 1902–1906.

1902	short tons	805	$88,616	1905 short tons	1,644	$149,153
1903	do	916	92,940	1906 do	2,274	204,973
1904	do	919	101,050			

CRYSTALLINE QUARTZ AND FELDSPAR.

PRODUCTION.

The production of crystalline quartz and feldspar in the United States during 1906 amounted to 24,082 short tons, valued at $121,671, as compared with 19,039 tons, valued at $88,118, in 1905. This is

an increase of 5,043 tons in quantity and of $33,553 in value. In quantity the production was exceeded only by that of 1903, which was 31,940 tons, while the value was greater in 1906 than for any previous year. There was a large increase in the production of abrasive feldspar, which figures prominently in the total production. The production of crystalline quartz in 1906 was obtained from the following States, named in order of their relative importance and with the number of producers in each: Connecticut, 3; Pennsylvania, 1; Wisconsin, 1. In the following table is given the quantity and value of crystalline quartz produced in the United States from 1895 to 1903, inclusive, and of crystalline quartz and feldspar for the years 1904 to 1906:

Production of crystalline quartz, 1895–1906.

1895	short tons	9,000	$27,000	1901	short tons	14,050	$41,500
1896	do	6,000	18,000	1902	do	15,104	84,335
1897	do	7,500	22,500	1903	do	8,938	76,908
1898	do	8,312	23,990	1904	do	[a] 31,940	[a] 74,850
1899	do	13,600	39,000	1905	do	[a] 19,039	[a] 88,118
1900	do	14,461	40,705	1906	do	[a] 24,082	[a] 121,671

GARNET.

PRODUCTION.

The production of abrasive garnet in 1906 in the United States amounted to 4,650 short tons, valued at $157,000. This falls short by 400 tons in quantity, but exceeds in value by $8,905 the production for 1905, which amounted to 5,050 short tons, valued at $148,095. In quantity and value the production is the next largest recorded, being exceeded only in 1905 in quantity and in 1901 in value. The average price per ton was $33.77, which is the highest since 1902, and is a large increase over $29.32 in 1905. The production came chiefly from New York, with part from Pennsylvania.

No production of garnet was reported from North Carolina in 1906, though it is expected there will be large production in 1907. According to reports,[b] the mine in Madison County owned by Mr. F. O. Werden, of Philadelphia, Pa., is being operated with an estimated production of 125 tons of garnet per month. The mine is to be equipped with steam drills and lighted by electricity, and it is hoped the output will be greatly increased. The product from this mine is used chiefly for commercial purposes, though it is said several very fine clear stones have been found.

In the following table are given the quantity and value of the abrasive garnet produced in the United States since 1895:

Production of abrasive garnet, 1895–1906.

1895	short tons	3,325	$95,050	1901	short tons	4,444	$158,100
1896	do	2,686	68,877	1902	do	3,926	132,820
1897	do	2,554	80,853	1903	do	3,950	132,500
1898	do	2,967	86,850	1904	do	3,854	117,581
1899	do	2,765	98,325	1905	do	5,050	148,095
1900	do	3,185	123,475	1906	do	4,650	157,000

[a] Includes feldspar used for abrasive purposes.

[b] Eng. and Min. Jour., August 10, 1907.

GRINDSTONES AND PULPSTONES.

PRODUCTION.

The production of grindstones and pulpstones during 1906 amounted to $744,894, as compared with $777,606 in 1905, a decrease of $32,712. Of the total value of the 1906 production $50,000 was contributed by pulpstones, which is practically the same as in 1905. The production came from the following States, named in the order of their relative importance: Ohio, Michigan, West Virginia, Montana, Missouri, and Wyoming. This is the same order as in 1905, though the production of Missouri and Wyoming were reported as the same. In the following table is given the value of the production of grindstones and pulpstones during the last five years:

Value of the production of grindstones and pulpstones, 1902–1906.

	1902.	1903.	1904.	1905.	1906.
Grindstones	$644,343	$687,476	$820,207	$726,536	$694,894
Pulpstones	23,088	33,970	61,320	51,070	50,000
Total	667,431	721,446	881,527	777,606	744,894

In the following table are given the values of the grindstones and pulpstones produced in the United States from 1903 to 1906, by States:

Value of grindstones and pulpstones produced in the United States, 1903–1906, by States.

State.	1903.	1904.	1905.	1906.
Ohio	$646,776	$767,552	$644,315	$644,720
Michigan	70,550	112,500	111,500	78,500
West Virginia, Missouri, and Montana	4,120	[a] 1,475	[a] 21,791	[a] 21,674
Total	721,446	881,527	777,606	744,894

[a] Including a small production from Wyoming in 1904, 1905, and 1906.

The value of the production of grindstones and pulpstones in the United States from 1880 to 1906 is shown in the following table:

Value of grindstones produced in the United States, 1880–1906.

1880	$500,000	1894	$223,214
1881	500,000	1895	205,768
1882	700,000	1896	326,826
1883	600,000	1897	368,058
1884	570,000	1898	489,769
1885	500,000	1899	675,586
1886	250,000	1900	710,026
1887	224,400	1901	580,703
1888	281,800	1902	667,431
1889	439,587	1903	721,446
1890	450,000	1904	881,527
1891	476,113	1905	777,606
1892	272,244	1906	744,894
1893	338,787		

IMPORTS.

The imports consist principally of pulpstones and a few grindstones for use in glass and optical trades; they are obtained from Newcastle-upon-Tyne and from Wales and Scotland. The value of these imports amounted to $134,136, as compared with $113,752 in 1905. No distinction has been made between finished and unfinished products since 1883. The value of the imports of pulpstones and grindstones has shown a steady increase during the last five years and are given in the following table:

Value of grindstones imported and entered for consumption in the United States, 1902–1906.

1902	$76,906	1905	$113,752
1903	85,705	1906	134,136
1904	93,152		

CANADIAN PRODUCTION.

The value of production of grindstones in Canada during 1906 amounted to $61,624, as compared with $57,200 in 1905. The value per ton of the product was but slightly greater than that for 1905, though much better than in 1904. In the following table are given the quantity in short tons, value, and average value per short ton of the Canadian production of grindstones during the last four years:

Production of grindstones in Canada, 1903–1906, in short tons.

Year.	Quantity.	Value.	Average value per ton.
1903	5,538	$48,302	$8.73
1904	4,509	42,782	9.49
1905	5,172	57,200	11.06
1906	5,545	61,624	11.11

OILSTONES AND SCYTHESTONES.

PRODUCTION.

The production of oilstones and scythestones in the United States during 1906 amounted to $268,070 in value, as compared with $244,546 in 1905. This is an increase of $23,524 over 1905, though it falls short of the large production of 1903 by $98,787. The production came from the same States as in 1905 and in the following order: Arkansas, Ohio, New Hampshire, Vermont, Indiana, and Michigan. With the exception of Ohio and Vermont, which have changed places, the order is the same as that for 1905. The production of Arkansas, Indiana, and two-thirds of that of Ohio is in oilstones and whetstones; while that of New Hampshire, Vermont, Michigan, and one-third of that of Ohio is in scythestones.

In the following table is given the value of the oilstones and scythestones produced in the United States from 1891 to 1906:

Value of oilstones and scythestones produced in the United States, 1891–1906.

1891	$150,000	1899	$208,283
1892	146,730	1900	174,087
1893	135,173	1901	158,300
1894	136,873	1902	221,762
1895	155,881	1903	366,857
1896	127,098	1904	188,985
1897	149,970	1905	244,546
1898	180,486	1906	268,070

IMPORTS AND EXPORTS.

The value of the imports of hones, oilstones, and whetstones in 1906 amounted to $83,863, as compared with $61,609 in 1905, a gain of $18,110. The imports amount to less than one-third of the home

production and are largely offset by exports of the Arkansas oilstones and the New Hampshire scythestones. The value of these exports can not be given, however, since no separate record is kept for them. The following table shows the total value of all kinds of hones, oilstones, and whetstones imported into the United States in the last five years:

Value of imports of hones, oilstones, and whetstones, 1902–1906.

1902	$56,456	1905	$65,753
1903	65,763	1906	83,863
1904	61,609		